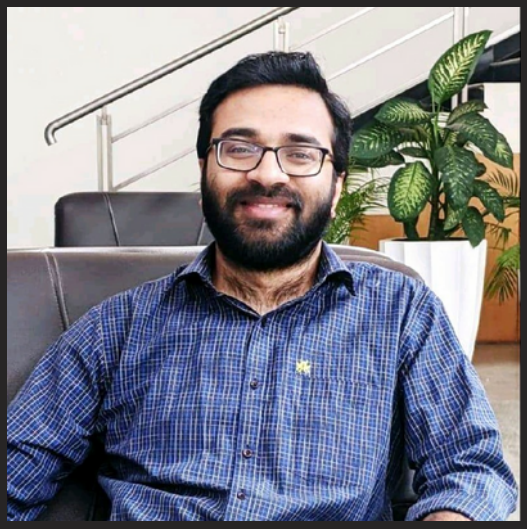

SUMMER
Carma
edition
THE CAREER MAGAZINE
JUNE 2023
SDC | IISER BHOPAL

FOREWORD



A wise man once said that if you are hungry, you are the one who should work for it as others only can advise which barely can satisfy the hunger. The same goes for career opportunities, one has to begin somewhere and it's never too early in this case.

I am delighted to introduce the 11th issue of SDC's biannual flagship magazine CarMa. The primary goal of this magazine is to guide undergraduate students of this institute in deciding suitable career goals after graduation. Further, this e-magazine also provides useful information regarding internships and career opportunities in academia, industry, and beyond. The journey of this e-magazine started back in 2017 and since then it is successfully circulating valuable articles on career goals and opportunities across the undergraduate community of the institute and beyond. Like every other issue, this issue also contains several interesting articles on career opportunities, internship experience, and relevant topics. In a nutshell, this edition covers topics on marine biology, blockchain, econophysics, careers in virology, development economics, astro data science, and cognitive science.

Not only do these articles provide information about probable opportunities in the future but also show a possible direction towards future options one can explore. I believe that this edition will be very informative and helpful for the readers and eventually, it will help them find their future goal soon. Compliments and thanks to the authors and the team for this edition.

Dr. Mitradip Bhattacharjee

INDEX

BLOCKCHAIN

BEYOND CRYPTO

We have all heard about Bitcoin, NFTs and cryptocurrencies and the pace at with these have grown. The backbone of these industries is Blockchain, a technology which can provide security on a scale unparalleled by any previous technologies. A rapidly growing industry with a lot of career opportunities and to learn more about blockchain and its applications here we have an insightful conversation with Mr. Rishank Jhavar. An accomplished professional serving as the Marketing Head at Deqode, where he demonstrates exceptional expertise in product strategy and branding. With a versatile skill set, he seamlessly dons multiple roles within the Deqode ecosystem, which includes Deqode Labs and Blaze Protocol. While excelling in the realms of artificial intelligence and blockchain technology, he consistently embraces new technologies, eagerly expanding his skill set. Rishank's passion for innovation and dedication to staying at the forefront of technological advancements enable him to devise effective product strategies and implement impactful branding initiatives.

Harsh Tandon
in conversation with
Mr. Rishank Jhavar

What is Blockchain?

The term “Blockchain” explains itself, it is a series of blocks which are interconnected by chains. The core purpose of this technology is to automate a crucial part of trading, that is trust. Throughout the years, various aspects of trading have been automated, increasing efficiency and decreasing the cost of any transactions. In the current world we don’t visit a retail shop to buy a new product, instead we cut the middle man involved in the negotiation and directly buy the goods from the seller using various e-commerce websites, we have automated the middle man in our trade.

One aspect we haven't yet optimized is trust, which is hard to achieve since it is inherently human in nature. If you are keeping your assets in a bank, you are trusting them. Similarly, if someone else is keeping their assets in a bank, they are trusting them. For a transaction to happen, this central body of trust (in this case bank) needs to be involved, otherwise this activity can be easily disrupted by any party. The question is, "Can we automate this central banking system?" Well sure enough the answer is yes, but "How does blockchain achieve this and how is that any better than the option we currently have?" Imagine you are playing a game of poker with someone, in the game of poker there needs to be a central entity, i.e. a book-keeper (central body of trust) who keeps track of which player has won how many rounds. Suppose your rival pays the book-keeper or somehow, they are able to change the notes of the book-keeper, you may lose a winning game because of this centralized entity. What blockchain does is instead of keeping one single ledger which can only be edited by one entity, there are copies of the ledger with each party involved (including bystanders) which any party can add a record into.

If anyone tries to act sneaky and add a victory to their ledger, they can be easily caught by an algorithm that is completely automated and is full-proof. This, of course, is an oversimplification of the main idea behind blockchain, but essentially, we are distributing the power of book-keeper in order to eliminate the unfairness and atomize trust.

Applications of this technology?

One of the most well known applications of this technology is cryptocurrencies like Bitcoin, Ethereum which most of us are aware of, but there are other interesting applications of blockchain like enhancing the supply chain

In a supply chain, we have multiple entities which are codependent on each-other. Let's say we have three companies A, B and C who rely on each-other to provide the raw material for the next step of production.

"...If anyone tries to act sneaky and add a victory to their ledger, they can be easily caught by an algorithm that is completely automated and is full-proof..."

In order to trade, they must either trust each other or trust a transport agency to keep track of their supply. Over long distances or in complex chains, the formal is not practical. Again, we have a central body that is keeping all the information which can be replaced by a more robust system using blockchain since this is the same as the case of a centralized banking network. Another important application is enhancing the healthcare system by making it more transparent for the healthcare providers without jeopardizing the privacy of patients to ensure fewer chances of error and fraud. But that's not all; any sector which requires trust and which is vulnerable to corruption can be easily improved by using blockchain. For example, blockchain can be used to create a secure and transparent system for managing intellectual property rights, where ownership and usage rights can be recorded and verified without the need for intermediaries. The applications of blockchain are extensive and diverse.

"...any sector which requires trust and which is vulnerable to corruption can be easily improved by using blockchain...."

As the technology continues to evolve and mature, we can anticipate the emergence of even more innovative use cases spanning various industries.

What are the job prospects?

Blockchain is a relatively new field with growing demand;as a result, job opportunities around this technology have been rising. Take for example, Polygon Technology, one of the biggest players in the blockchain industry, was established in 2017 by four Indian software engineers and currently has $2.5 Billion assets, including $2 Billion MATIC (polygon's very famous native token). Well-established IT companies like Accenture, Google, Infosys, and Microsoft are offering jobs around blockchain research and development, there also are various startups which are dedicated to blockchain.

Due to the niche (specialized) nature of this technology, the competition for these jobs is low. If anyone wants to make a career in Blockchain, becoming a blockchain developer is a great gateway. A blockchain developer designs, develops and maintains blockchain based applications, they are also responsible for writing smart contracts and working with existing systems to integrate blockchain technology. Blockchain marketing and consulting is another important aspect of blockchain. Unlike other technologies, blockchain requires a specialized marketing team consisting of people who understand how this technology works and its real-world applications. There are also specialized management jobs which oversee the development of blockchain projects. They ensure the completion of the project on time and within the budget. Such jobs require both deep knowledge about the field and good management skills, which makes them more in demand. There are also jobs like Blockchain-quality engineers, who ensure the optimization and quality of projects and research jobs, which we can come to later. Overall, the job prospects in blockchain are promising and are growing rapidly. .

These jobs are challenging but at the same time are rewarding, offering competitive salaries and providing opportunities to work on exciting new projects.

What are the research opportunities in blockchain?

Blockchain is a relatively new field,and as a result currently a lot of tech giants are investing in the research around this field and its applications. A lot of work is being done to optimize this technology (web3) in order to bring it to the same level as our current technology (web2) in terms of processing.

"...any sector which requires trust and which is vulnerable to corruption can be easily improved by using blockchain..."

"...This huge discrepancy between web2 and web3 space is slowly being worked upon...."

For example, the Visa network which can perform tens of thousands of transactions per second compared to bitcoin (one of the earlier forms of crypto) which can only perform 2–3 transactions per second. This huge discrepancy between web2 and web3 space is slowly being worked upon. Various other cryptocurrencies emerged after Bitcoin like Ethereum which can perform 30 transactions per second, followed by Litecoin which can perform 56 transactions per second. Currently, polygon blockchain can process up to 72,000 transactions per second with a slightly high processing cost. Blockchain systems rely on consensus algorithms to ensure that the distributed ledger is accurate and tamper-proof. In order to reduce this cost, there is ongoing research focused on developing new algorithms that are more efficient, secure, and scalable.

Moreover, even though blockchain systems are designed to be secure and tamper-proof, there are still many potential security and privacy vulnerabilities that need to be addressed. Research in this area is focused on developing new techniques for securing blockchain systems and ensuring the privacy of users' data. There is also one more problem that researchers are working on, since there are multiple blockchain systems, moving assets and data across them requires a centralized exchange. In order to remove this, various new techniques are being tested to enable these systems to interoperate with one another. Since blockchain systems are often decentralized, there is an interesting ongoing research focusing on developing new techniques for governance that can ensure the long-term viability and sustainability of these systems.

How can an individual learn more about this field?

Firstly, one must be familiar with programming, some basic cryptography and data-structures, since these are essential to dip into becoming a blockchain developer and building products on existing applications, which is something a majority of job descriptions look for these days.

A solid foundation in programming languages like Java and C++ is important, as they are often used to build blockchain applications and platforms. Another such language is Python, which is not only used to build applications, but also to build tools for blockchain. Another useful programming language tailor-made for blockchain design and writing smart contracts is “Solidity” which is similar to JavaScript and is designed to be easier to learn. It is also used in various blockchain development tools like “Ethereum” which is an open source blockchain platform.

"...Rather than that, they can read about blockchain in general and learn more about it..."

There are other blockchain tools available in the market which can help you get a hands-on experience with blockchain. There are online courses about this topic which students can follow to learn more about this technology along with books which cover everything from basics of blockchain to advanced topics like cryptography which can be an interesting read for anyone who is into encryption and decryption techniques. One can also join various online blockchain communities, which can be a great way to stay up-to-date with the latest developments and trends.

Suggestions from interviewee:

Most of the students have heard the term “blockchain” in the context of cryptocurrency because they are interested in cryptocurrency as an investment and seeing how it works. Rather than that, they can read about blockchain in general and learn more about it; they can see how the applications of this technology extends further than just cryptocurrency.

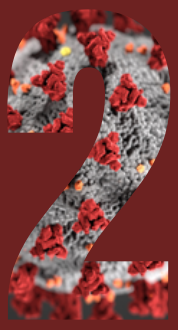
One good place to start is where it started i.e., bitcoin whitepaper, it might be slightly complicated for a beginner, but you can get a rough idea of what are the core principles and philosophy of blockchain from there. You can teach yourself some java-script, build some application on solidity and reading up on standard development processes and data structures, and eventually, you will have every basic skill required to enter this field. This technology is something everyone knows about and if interested, dip into understanding it and consider it a potential career as it is a relatively new field and provides compelling salaries and experiences.

AUTHOR'S NOTE

Blockchain technology has emerged as a transformative force across various industries, revolutionizing the way we perceive and interact with digital systems. In this article, we delve into the research purpose of blockchain and its profound implications on our society.

As an author, my goal is to shed light on the significance of blockchain beyond its popular association with cryptocurrencies. While cryptocurrencies undoubtedly play a crucial role in the blockchain ecosystem, it is essential to explore the broader research landscape that this technology offers.

This article aims to showcase the diverse applications that blockchain serves. From enhancing data security and privacy to facilitating decentralized governance models, blockchain has the potential to reshape industries such as finance, healthcare, supply chain, and beyond.



Unleashing the Viral Potential

Dynamic Career Avenues in Virology

Kaustubh Nyati

What is Virology?

Virology delves into the intricate study of viruses, encompassing a wide spectrum of infections ranging from commonplace ailments like chickenpox to the emergence of formidable diseases such as Coronavirus, SARS, Zika, and Ebola.

The branch of viral sciences deals with the study of viruses and virus-like agents, including (but not limited to) their taxonomy, disease-producing properties, cultivation, and genetics.

Researchers in this field study a broad range of issues, including viral pathology, viral oncology, emerging viruses, virotherapy, viral replication, virus-cell interactions, and plant virology.

What is the importance of Viruses and Virology?

Given that viruses are of medical and veterinary significance, virology has increasingly become one of the most important sub-disciplines of microbiology that has allowed researchers to not only discover treatments and cures for the diseases they cause but also use them for pharmaceutical purposes.

Who are virologists?

Virologists study viruses that affect humans, animals, insects, bacteria, fungi, and plants in the community, clinical, agricultural, and natural environments. A virologist is expected to learn about how viruses spread, how to isolate them, and how to diagnose, treat and prevent infections. They spend a generous amount of their time in microbiology or virology laboratories.

What does a Virologist do?

They advise other doctors over the phone, attend multidisciplinary meetings, and visit staff and patients in wards and clinics. They may even work internationally, for example with the WHO, and be involved in global health problems. Antiviral Drug Discovery is a prominent field of research.

"...A virologist is expected to learn about how viruses spread, how to isolate them, and how to diagnose, treat and prevent infections. They spend a generous amount of their time in microbiology or virology laboratories..."

Some of the hottest areas of research in virology today include:

Emerging viruses, such as Ebola, Sin Nombre and SARS. These have only recently been discovered, and are the focus of a tremendous amount of fascinating research.

Viral pathogenesis, which looks at how viruses cause disease. Much of the research here involves using animal studies, and information from host and viral genomes to determine virulence. These infections in plants can have a terrible impact on agriculture in developing nations.

What education and training are necessary to become a virologist?

At the **undergraduate** level, one could study Microbiology or also pursue MBBS, Biomedical Sciences or Biotechnology. For **Masters**, you could study Microbiology, Medical Microbiology, Immunology or Virology. Specifically, with regard to biology, a major issue is that there are a large number of people with at least a masters graduating each year. Hence, even though the IISER tag gives you an edge, in effect, unless you have a higher qualification or experience, you won't be able to stand out in the crowd. A Doctoral Degree, **Ph.D**. in Microbiology (specializing in Tropical Medicine or Infectious Diseases) opens up a host of new avenues and is necessary for the uppermost posts in this field, such as a professor at a college/university, researcher, or a research director. Post a Ph.D., there are a plethora of industry openings available. **Certifications** are available for clinical microbiologists and for those who specialize in the fields of food safety and quality, pharmaceuticals and medical devices. Certification may help workers gain employment in the occupation or advance to new positions of responsibility.

Skills Needed to Become a Virologist

- Molecular Biology skills
- IT & Software skills
- An analytic and inquisitive mind
- Ability to be calm under pressure
- Good communication skills

There are a host of opportunities available. You may reflect on what aspect of virology you are interested in (i.e. research, public health, or medical virology), since each aspect needs different education and training.

"...A Doctoral Degree, Ph.D. in Microbiology (specializing in Tropical Medicine or Infectious Diseases) opens up a host of new avenues and is necessary for the uppermost posts in this field..."

Top Colleges for Virology in India

- National Institute of Virology, Pune
- Sri Venkateswara University, Tirupati
- Savitribai Phule Pune University, Maharashtra
- Manipal University, Karnataka
- Amity Institute of Virology and Immunology, Noida
- Karpagam Academy, Coimbatore

Top Universities for Virology Abroad

USA

- Harvard University
- University of Texas Health Science Center at Houston
- University of Chicago
- University of Pennsylvania
- Ohio State University
- University of San Francisco

UK

- London School of Hygiene & Tropical Medicine
- Imperial College London
- University of Cambridge
- University of Manchester
- University of Warwick
- University of Edinburgh

Canada

- University of Toronto
- University of British Columbia
- McGill University
- University of Alberta
- University of Quebec

Other Countries

- University of Melbourne
- University of Queensland
- Massey University
- University of Freiburg
- Umea University

What are the Job Prospects?

According to the U.S. Bureau of Labor Statistics, the job prospect for virologists has increased by 11 % between 2006 and 2016 and a 10% increase in demand for epidemiologists trained in areas such as virology, by 2022. And microbiologists expect to see a 7% increase in job demand. Virologists who are well trained in statistics may also see excellent job demand, with a huge 27% increase in jobs for statisticians by 2024.
The employment opportunity for virologists looks good, more so, with the appearance of new viruses every day and the process of constant research. This will become even more prominent in the coming years, as government budgets focus more of their resources on the prevention of disease before it strikes, rather than dealing with the issue after people are unwell. This focus on preventive health is what is driving demand for more public health professionals of all kinds, including those trained in virology.

Top Companies

1. Dr. Lal PathLabs
2. Manipal Hospitals
3. SRL diagnostic
4. Pfizer
5. Sir Ganga Ram Hospital
6. Thyrocare
7. Athenahealth
8. ITC
9. Max Healthcare
10. Nucleome Informatics
11. ThermoFischer Scientific,
12. OmiX Research and Diagnostics Laboratories

"...with the appearance of new viruses every day and the process of constant research. This will become even more prominent in the coming years..."

What JOBS are available?

With a degree in Virology, you can do a lot of different things.
You can get into a **Forensic job**, remember Dr. Saluke from the CID show.
You can get into the **Research** field.
Pharmaceutical production plants like vaccines, different types of drug products, etc are good options.

You can work in a **Pathology lab**.
Apart from private labs, every **government and private hospital** will have their own lab so one could get a job there as well.
You can consider getting into the **education field, a lecturer**, even without a NET exam. You will land a healthy stipend and get a chance for a government job as well.
You can get into Government **Food testing** as well as Private Facilities with the title of **food safety officer.**
You can get into Government **water testing facilities** as well as Sewage treatment plants.
A microbiologist can even get a job at a **soil testing facility**.

Every **food production company** has its own microbiologist.
QA/QC person in different pharmaceuticals as well as many production units also requires a microbiologist.
There are many different IT companies that require life science graduates, specifically Microbiology graduates. They always need **Editors** and other positions for editing scientific papers.

A microbiologist can also get a job in a **stem cell center**. Either it could be in R&D or it could be in the **marketing field** as well.
Microbiology graduates can also become **Sales Executives** in the pharma industry.
The **teaching and professional training sector** is booming in India, and is now becoming an extremely lucrative option for fresh graduates. And these jobs are pretty well-paid too.
At any given time, there's always a job available in the **Production Unit.**
Once you have certain experience in the field, this subject .has a very bright scope to even get PR and a very high paying job abroad in developed countries like USA, Canada, Australia and UK.

Additionally, several **corporate-style semi-research oriented entities** like diagnostic labs, testing labs, and corporate R&D departments - all these are increasingly providing an active intake for fresh Masters students.
Extensive diversification is also something you can consider, if you want to almost fully shift your focus from the sciences. **Central services** (UPSC etc),

and **MBA** are also pretty open options, though they won't be in sync with what you actually studied and trained for. Still, if that gives you a solid career, why not?

Some Different departments in which virologists can work are

- Data Science and Analytics
- Imaging and diagnostics
- Healthcare and life sciences
- Professional services
- Human Resources
- Legal and regulatory
- Infrastructure

When you put these reasons together, virology is a very exciting, challenging and rewarding career path, something anyone interested in public health should consider.

AUTHOR'S NOTE

Virologists, the unsung heroes of our world, dedicate their lives to the pursuit of knowledge and the betterment of humanity. In this short piece, I wanted to shed light on their extraordinary work and the significant role they play in keeping our world safe from diseases, who willingly face risks each day, venturing into the realm of infectious agents to conduct groundbreaking experiments.

Working in a virology lab is far from a typical 9-to-5 job. Virologists must constantly adapt to various experiments and tasks, always prioritizing biosafety and biosecurity. Despite the demanding nature of their work, the lab environment offers excitement and wonder with the utilization of cutting-edge equipment.

In addition to the inherent challenges, virologists find solace in the stability of job security, particularly in the public health sector with excellent compensation. Ultimately, the immense challenges and remarkable opportunities in virology research are outweighed by the profound sense of fulfillment that comes from contributing to the greater good.

This note serves as a heartfelt acknowledgment of the invaluable work of virologists and an invitation for readers to appreciate their extraordinary contributions. Together, let us honor their commitment to creating a healthier and safer world for generations to come.

3

The Physics of Markets

The hidden connections between Economics and Physics

Manas Nandan

What is Econophysics & How Does it Combine Physics and Economics?

"By applying the principles of physics to the study of financial markets, Econophysics opens up a new realm of understanding, uncovering hidden patterns and connections that can revolutionize our approach to economics."
- Dr. Brian Arthur

Have you ever heard of the field of Econophysics? It's a fascinating interdisciplinary area that combines physics and economics to study financial markets and economic systems. It emerged in the 1990s when physicists began applying their mathematical and statistical tools to economic problems, partly inspired by chaos and complexity theory.

The term "Econophysics" was first coined by the renowned theoretical physicist Eugene Stanley at a conference in Kolkata, India. He defined it as the activities of physicists working on economic problems to test new conceptual approaches deriving from the physical sciences. Interestingly, he noted that it's not necessary to master economics to study Econophysics.

"...Different types of Econophysics, including experimental and observational approaches, analyse real data from real markets. Theoretical approaches try to find microscopic models that accurately reflect experimental data..."

Econophysics seeks to describe and model the universal behaviours of financial markets as open systems where new information and investments are mixed. This field applies various models and concepts from the physics of complex systems, such as statistical mechanics and microsimulation. The goal is to understand socioeconomic problems through physical methods better.Econophysics is an interdisciplinary field that utilises concepts and tools from physics to study economic systems. One key input from physics is statistical mechanics, which provides a framework for understanding the behaviour of large economic systems. Econophysics also employs network theory to analyse economic networks and complexity theory to understand the behaviour of complex economic systems. Additionally, Econophysics utilises the methods of dynamical systems theory to study the evolution of economic systems over time

understanding of economic phenomena, such as stock market crashes and price fluctuations. Econophysics is a promising field at the intersection of physics and economics, offering the potential for new insights into economic systems and the development of more accurate economic models.

Different types of Econophysics, including experimental and observational approaches, analyse real data from real markets. Theoretical approaches try to find microscopic models that accurately reflect experimental data.

Physicists' interest in the social sciences is not new; One of the many examples is Jan Tinbergen, who won the first Nobel Memorial Prize in Economic Sciences in 1969 for having developed and applied dynamic models for the analysis of economic processes, who was originally a student of physics. Seeing how physicists and economists work together to uncover the mysteries of financial markets and economic systems,

recently awarded Nobel Prizes, including Tinbergen's, recognise outstanding original contributions that use physical methods to develop a better understanding of socioeconomic problems.Econophysics is a promising field that will continue to advance our knowledge of the world around us.

Exploring Career Paths in Econophysics: Opportunities and Applications

Research

The study of Econophysics offers a vast array of research opportunities that numerous prestigious universities and research institutions are currently pursuing. This field provides a distinct platform for developing novel mathematical models and conducting advanced computer simulations, facilitating a more comprehensive understanding of the intricate behaviours displayed by financial systems. Collecting and analysing substantial amounts of data are crucial in enabling informed predictions, which can guide investment decision-making. By extensively analysing financial markets and systems, Econophysics has the potential to make significant contributions to this domain.

Finance

Recently, there has been a notable rise in the fascination towards applying Econophysics within the finance industry. This is primarily to enhance the abilities of financial analysts to accurately predict market trends, mitigate risks, and develop effective investment strategies. Econophysics offers a unique approach to analysing financial data by providing a more comprehensive understanding of the intricate interactions between participants in the financial market. By leveraging this approach, financial analysts can make more informed decisions resulting in improved investment outcomes with greater accuracy.

"...Econophysics offers a unique approach to analysing financial data by providing a more comprehensive understanding of the intricate interactions between participants in the financial market..."

Data Analysis

In today's data-driven world, it's essential to have the ability to analyse vast financial datasets. This is where the field of Econophysics comes in, which applies mathematical and statistical techniques from physics to economic systems.

Econophysics can be a game-changer for data scientists, enabling them to identify complex patterns and behaviours in financial markets that would be challenging to detect otherwise. Leveraging Econophysics methods can lead to more precise predictions and data-driven strategies, which is why it's a valuable tool for data scientists looking to stay ahead of the curve.

Academia

For those interested in research and teaching, academia offers another promising career option. Pursuing a PhD in Econophysics or a related field can lead to opportunities for education and conducting research in universities and research institutes.

Academics can significantly contribute to the area by developing new mathematical models and running computer simulations to better understand financial systems' behaviour. They can also mentor and guide the next generation of Econophysics professionals.

"...Leveraging Econophysics methods can lead to more precise predictions and data-driven strategies, which is why it's a valuable tool for data scientists looking to stay ahead of the curve..."

Policy Making

Econophysics holds tremendous promise in shaping economic policy decisions at various levels, be it local, national, or even international.

"...Econophysics holds tremendous promise in shaping economic policy decisions at various levels, be it local, national, or even international...."

The dedicated professionals in this field rely on the insightful findings of Econophysics research to shed light on critical economic policy matters, spanning from ensuring financial stability and addressing inequality to fostering robust economic growth. By harnessing the power of Econophysics research, policy analysts can unlock valuable insights, enabling them to make well-informed decisions that pave the way for enhanced economic prosperity and well-being for everyone involved.

Risk Management

The application of Econophysics methodologies has become increasingly relevant in the development of risk management frameworks, as it allows for more accurate and robust risk assessments. Risk managers now utilise Econophysics models to analyse and manage financial risks associated with investment strategies, portfolios, and various financial instruments. This highlights the potential for interdisciplinary collaboration and the convergence of different scientific fields to produce innovative solutions within the finance industry.

Consultancy

Econophysics also presents a promising career path for undergraduates interested in pursuing consulting. The field equips consultants with the necessary skills to analyse financial data and predict trends, which can be invaluable to businesses and organisations looking to make informed investment decisions and develop effective strategies.

By identifying potential investment opportunities and managing risks, Econophysics consultants can help companies develop sound financial plans and remain competitive across a variety of industries. Overall, Econophysics consultants bring a wealth of expertise to the table, making them valuable assets to any organisation looking to succeed in the financial realm.

In this section, we will delve into the key skills that are essential for a successful career in Econophysics.

"...Professionals in this field must be well-versed in economic theory, financial markets, and financial instruments to accurately interpret and analyse data...."

Key Skills for a Successful Career in Econophysics

Econophysics is an extraordinarily fascinating and rapidly evolving field that amalgamates principles and techniques from both economics and physics. This approach is primarily used to scrutinise and acquire valuable insights into economic systems and financial markets. With the ever-increasing emphasis on data analysis in the finance industry, the demand for professionals with sound knowledge of Econophysics is on the rise.

Knowledge of economics and finance

A strong understanding of economics and finance is crucial for econophysicists as they use economic and financial data to build models and make predictions. Professionals in this field must be well-versed in economic theory, financial markets, and financial instruments to accurately interpret and analyse data. A solid foundation in economics and finance allows econophysicists to identify patterns and trends in data and use this information to make informed decisions.

Knowledge of physics and mathematics

Econophysics combines principles from physics and mathematics with economics and finance to analyse and understand financial markets. Econophysicists use tools such as probability, statistics, and stochastic processes to develop models that help explain the behaviour of financial systems. A thorough understanding of these mathematical concepts and their application in Econophysics is critical for econophysicists to build robust models and make sound predictions.

"...Econophysicists use tools such as probability, statistics, and stochastic processes..."

Programming skills

Programming skills are essential for a career in Econophysics. Professionals in this field must be able to write computer programs to analyse data, build models, and simulate financial markets. They should have proficiency in programming languages such as Python, R, and MATLAB. Proficiency in SQL and other database management tools is also an advantage

Data analysis skills

Econophysics deals with the use of large datasets from the financial markets, so professionals in this field have to have strong data analysis skills. They must know how to use data mining, machine learning, and artificial intelligence techniques. They also have to be able to use statistical tools such as regression analysis, time series analysis, and Bayesian inference.To sum up, Econophysics is a promising field with many career opportunities for undergraduate students.

From research and finance to data science, academia, and consulting, students have many options to impact the field and help shape its future significantly.With its ability to analyse and understand complex financial systems, Econophysics is set to become an essential tool for understanding the behaviour of financial markets and forecasting future trends. As the field continues to grow, the demand for Econophysics professionals will go hand in hand, so be it a physics, mathematics, or economics enthusiast, Econophysics promises a rewarding career.

AUTHOR'S NOTE

As the author, I found the fusion of physics and economics in Econophysics to be incredibly intriguing. This article aims to introduce readers to this interdisciplinary field, explore its core concepts, and highlight the diverse career opportunities it presents. By applying physics-based methods, Econophysics provides valuable insights into financial markets and economic systems. From research and finance to data analysis, academia, policy-making, risk management, and consultancy, Econophysics offers a range of paths for those interested in this fascinating field. The collaboration between physicists and economists in unravelling market complexities and the recognition through Nobel Prizes further emphasises the field's significance.

References:

https://www.sciencedirect.com/topics/economics-econometrics-and-finance/Econophysics
https://www.mdpi.com/1099-4300/23/2/254
https://rdcu.be/c9G1q
https://www.americanscientist.org/article/Econophysics-a-new-way-to-look-at-financial-markets
https://www.tandfonline.com/doi/abs/10.1080/713665670
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3964444/
https://www.emerald.com/insight/content/doi/10.1108/10867370710715480/full/html
https://www.theglobeandmail.com/report-on-business/Econophysics-a-new-way-to-look-at-finance/article20403791/
https://towardsdatascience.com/Econophysics-and-data-science-the-future-of-economics-4ce4e4e4fa8a
https://www.mdpi.com/2227-7072/5/1/7/htm
https://en.wikipedia.org/wiki/Econophysics

A Dive Into The World Of

MARINE BIOLOGY *& Beyond*

An Introduction To Marine Biology

Hemal Bapat

As one of the largest parts of our planet, oceans have often invoked curiosity and awe within us. Though they cover around 71% of our planet's surface, we have barely scratched the surface when it comes to understanding them. Scientists reckon that no more than 5% of the oceans have been explored, meaning there is much to investigate, study and analyse. A career in marine biology provides the perfect opportunity to do just this. Marine biology is the study of biodiversity, function and ecology of marine organisms. Marine biologists investigate a variety of topics, from the adaptation of certain species to the various chemical and physical properties of seawater to the availability of light at different depths and the movements of the ocean. They study everything from tiny plankton to massive whales, from coral reefs to deep-sea vents, and from the tropics to the poles.

Today, numerous tools are available for exploring the oceans, and many more are being developed. The most basic tools are the variety of devices used for collecting specimens. The frequency and speed of ocean surface currents close to the coast are measured using high-frequency radars.

SONAR(Sound Navigation and Ranging) is employed to find objects in the water and measure the ocean's depth. Environmental satellites are used to monitor and collect a variety of data. ROVs(Remotely Operated Underwater Vehicles) are equipped with sensors and sampling equipment to gather data from the ocean. Data from various marine settings is collected, processed, analysed, and displayed using advanced computers. Does working with tools like these seem interesting to you? If so, let's look at how you can work in a field that will allow you to employ these tools.

"...It is not even necessary to opt for marine biology during the course of your undergrad...."

How To Kick-off Your Career?

Wondering how to get started in this field? Well, there is no specific blueprint.It is not even necessary to opt for marine biology during the course of your undergrad. You may major in any related disciplines like biology, zoology, botany, biotechnology, oceanography, earth science, etc.

However, it’s advisable to gain as much knowledge on your own, as you can to confidently move forward with your choice of career. After this, most people opt for a master's degree in marine biology or related fields. On completion of your master's in marine biology, you will be eligible for entry-level jobs in the field. You can do internships to gain experience and relevant knowledge. After a master's,one can go for M.Phil or PhD in marine biology if they are interested in doing their own research about particular topics or are interested in faculty positions.

Apart from an academic degree, one also needs certain skills like an affinity for the marine environment, good statistical skills, practical fieldwork skills, patience, observation, teamwork, communication skills, management, and problem-solving to pursue a career in marine biology.

Some of the top marine biology institutes in India are:

- National Institute of Oceanography, Goa
- Marine Biology Regional Centre, Chennai
- Centre for Marine Living Resources and Ecology, Ministry of Earth Sciences, Kochi

Some of the best marine biology institutes abroad are:

- James Cook University, Australia
- Ocean University of China
- Sorbonne University, France
- Aarhus University, Denmark
- University of Tasmania, Australia
- And many more

"...One can work as a marine biologist in the public sector, the commercial sector, non-research, consultancy, business, and academia..."

Career Paths In Marine Biology: Areas and Opportunities

One can work as a marine biologist in the public sector, the commercial sector, non-research, consultancy, business, and academia. One can also work in industries like biotechnology, pharmaceuticals, manufacturing, energy generation, construction, and manufacturing.

However, the availability of these jobs depends on the economic circumstances. Additionally, one can find employment in academia as a researcher, mentor, or instructor, guiding the future class of marine biologists. Various national laboratories are also a source of opportunities.Yet another job profile is working as a research scientist for a consulting firm, assessing data, coming to conclusions, and resolving issues. Many NGOs work with marine scientists to help with some of the most substantial issues in the world. A career outside of research is also possible in fields like environmental education, tourism, aquaculture, and water quality control.

Marine biology is quite an interdisciplinary and broad field, thus it has numerous branches. One can choose to specialise in any one of them. Here is an overview of some of these specialities.

Oceanographer

They apply concepts from chemistry, biology, geology, meteorology and other scientific disciplines to study the oceans. They can work in any of the four branches:

- Physical oceanographers study the physical characteristics of the ocean such as temperature and the motion of water due to waves, tides and currents.
- Chemical oceanographers study the biogeochemical cycles that alter the composition of seawater.
- Biological oceanographers study the biological organisms in the marine environment and their life cycles.
- Geological oceanographers study the evolution, structure and features of oceanic basins.

Environmental Marine Biologist

One of the hottest topics as well as an area to work in is environmental marine biology. Environmental marine biologists study the health of the ocean and the threats posed to marine life by pollutants, sediments and runoff. They may study the effect of oil spills or other chemical hazards on the ocean environment. Environmental biologists also study Benthic environments on the ocean bottom to understand issues such as the chemical makeup of sediment, the impact of erosion, and dredging ocean bottoms on the marine environment.

"...Marine biology is quite an interdisciplinary and broad field, thus it has numerous branches. One can choose to specialise in any one of them..."

Marine Biotechnologist

They use biotechnology, molecular and cell biology, and bioinformatics to create products from marine organisms. They also focus on ocean exploration for creating new chemical products, pharmaceutical drugs and improving the safety of aquaculture and seafood, as well as bioremediation and biofuels. Their work is essential to utilise the vast potential of the marine environment to enhance human life.

Marine Mammalogist

The study of marine mammals, such as dolphins, whales, and seals, is one of the most fascinating fields in marine biology, since they are some of the most intelligent animals on the planet. Marine mammalogists study the behaviour, reproduction, population, health as well as conservation of these animals and understand the threats they face from human activities.

"...Their work is essential to utilise the vast potential of the marine environment to enhance human life..."

Marine Microbiologist

They study marine microorganisms, their biodiversity and their ecology. This study helps in understanding the significance of marine microorganisms in the marine food chain and ecosystem. Researchers also try to find new microbes that could be utilised to develop new drugs that may be used to treat various diseases.

Ocean Engineer

Ocean engineers build systems that control and monitor coastal environments. They design technologically advanced products for underwater navigation, communication and exploration. They also create machines like underwater unmanned vehicles or ROVs. To pursue a career as an ocean engineer, one should get a degree in any of the following branches - ocean engineering, environmental engineering, mechanical engineering, petroleum engineering or naval architecture. Some universities may also offer a degree specifically in ocean engineering.

Ichthyologist

They study all aspects of fish from their diversity, classification and morphology to their behaviour, ecology and evolution. Plenty of ichthyologists are also employed in the aquaculture and fishing industries.

Marine Ethologist

Marine ethologists study the behaviour of marine mammals. Their study helps in understanding the threats to these animals from a wide range of human activities such as pollution, fishing and climate change. It also helps to develop strategies for conserving these species.

Hydrologist

They study the distribution and movement of water above and below the surface of the Earth. They also focus on the ways in which human activities affect water availability and conditions. Most hydrologists either have a BSc. in hydrology or geography or a BTech. in civil or environmental engineering. Following this, they may opt for a master's degree in their field of interest.

Marine Archaeologist

Marine archaeologists excavate things in the deepest parts of oceans and seas. In addition to excavating ships and other things from the ocean bed, marine archaeologists also excavate human debris and civilisations buried underwater for many years. Most marine archaeologists have a bachelor's degree in marine science and a master's or doctoral degree in related fields like ecology or archaeology.

Deep-sea Ecologist

Deep-sea ecologists study the characteristics and processes of the deep sea. Their research focuses on deep ocean gases as a potential alternative energy source, how deep-sea organisms adapt to their habitat of high pressure, darkness, and the thriving biological communities sustained in deep-sea hydrothermal vents.

"...In addition to excavating ships and other things from the ocean bed, marine archaeologists also excavate human debris and civilisations buried underwater for many years..."

Importance Of The Field And Its Scope In The Future

It is believed that life first originated in seawater. Essential ecosystems like coral reefs, kelp forests and seagrass meadows which provide vital services like nutrient cycling and carbon sequestration are also present in marine habitats. However, they are also under threat from a range of human activities and the increasing human population. Therefore, it is crucial to study the ocean to comprehend why we need to protect it. Marine biology provides an opportunity to work on the impact of global warming, pollution and the rise in CO2 levels on the marine environment, which are major global issues. Improving technology has also increased the scope of marine exploration.

The ocean supplies us with most of the oxygen we breathe, food to eat and regulates our climate. Oceans also support the economy through shipping, fishing, and tourism. As the ocean is so important, there are many challenges facing us regarding how we can use the oceans and since creating a sustainable future is a popular focus of many institutions, the future of marine biology looks promising. Marine biology is a fascinating and vitally important field of study that allows us to explore the mysteries of the ocean and the insights and innovations of marine biologists will be more important than ever in ensuring a healthy and thriving ocean for future generations. As marine biology is a flourishing field with what seems to be a very bright future ahead, one should definitely give some thought to making a career in this area

"...Essential ecosystems like coral reefs, kelp forests and seagrass meadows which provide vital services like nutrient cycling and carbon sequestration are also present in marine habitats. However, they are also under threat from a range of human activities and the increasing human population..."

AUTHOR'S NOTE

Robert Ballard, a visionary oceanographer who is perhaps best known for his investigation of the *Titanic* shipwreck, has said, "The deep sea is the largest museum on earth, it contains more history than all the museums on land combined, and yet we're only now penetrating it." In the process of writing this article, I've come to realise just how true this is. The world of oceans is quite vast and diverse, and there is so much to explore. The ball is in our court, and it is up to us to ask questions and discover more about this world through any field that may interest us. I hope this article has provided you with some insights into the different branches and helped you understand why a career in this field would be an exciting possibility.

REFERENCES

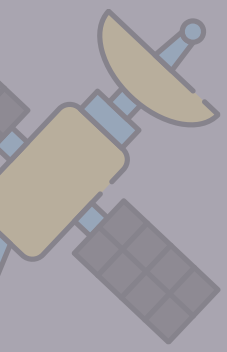
https://www.marinebio.org/creatures/marine-biology/
https://oceanexplorer.noaa.gov/technology/technology.html
https://education.nationalgeographic.org/resource/hydrology/
https://ocean.tamu.edu/about/what-is-oceanography/index.html
https://www.isaaa.org/resources/publications/pocketk/52/default.asp
https://www.britannica.com/science/marine-biology
https://globalscholarships.com/best-marine-biology-schools-world/
https://globalscholarships.com/best-countries-marine-biology/
https://www.marineinsight.com/careers-2/what-is-ocean-engineering/

Astro Data Science

The surprising applications of data science in Astronomy

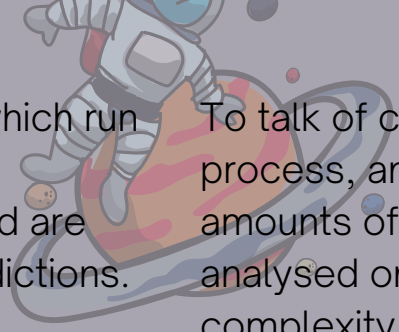
Aneesh Diwanji

In the times which we live in, information has gained power and data science is now a buzzword. Data surrounds us all, from the countless pages on the internet, to shopping bills, customer data, buyer and seller data, shipping data, financial data, transactional data, and the list goes on. The amount of data generated in the world has climbed up to hitherto unimagined scales, and it continues to increase. With this, however, comes the drawback, that analysing, summarizing and making predictions becomes increasingly difficult with the scale. This highlights the importance of data science as both, a discipline of study and a tool to transform the operational processes in the real world.



What is data science?

Data Science is the field of applying advanced analytic techniques and scientific principles to extract valuable information from data for specific purposes, which are usually building models, and making predictions.



These models are mechanisms which run on the summaries that data scientists conclude from data, and are applied to new data to make predictions. Donald Farmer, the owner of the analytics firm TreeHive Strategy, outlined these six essential steps in an article outlining the data science process :

1. Identify a hypothesis to test.
2. Gather data and prepare it for analysis.
3. Experiment with different analytical models.
4. Pick the best model and run it against the data.
5. Present the model to business executives.
6. Deploy the model for ongoing use with fresh, new data.

Note, that this does make this very similar to the scientific method. However, the primary concern is to apply this to accurately fit a description of observed phenomena, unless the field of interest is actually research within the framework of data science, itself, as a discipline.

"...These models are mechanisms which run on the summaries that data scientists conclude from data..."

To talk of challenges in this process, analysing the vast amounts of data that are typically analysed only adds to the complexity. Furthermore, the data being analysed may contain structured, unstructured and semi-structured data, which only increases the complexity more.

Skills required in data science:

1. Programming
2. Statistics and Probability
3. Data wrangling and management: This essentially refers to the process of cleaning and organizing complex data sets into ones, which are easier to read and access.
4. Machine learning and deep learning: This boosts the efficiency of the gathering and synthesis of data, as well as predicting the outcome of future data sets.
5. Data mining: Refers to the process of sorting through big data sets, to identify patterns or relationships, which may lead to results if analysed using data analysis.

6. Data visualisation and effective presentation: Visualisation helps to intuitively grasp
the underlying concepts, and make them more readable to people from other backgrounds, thus making it more impressionable in general.
7. **Cloud computing:** Data Science often involves the use of cloud computing tools to help
analyse and visualise data stored in cloud platforms.
8. Interpersonal and Team work skills: An indispensable skill, since data scientists and
analysts usually work in teams.

These skills arm data scientists and analysts to effectively function as a unit and produce high
quality results.

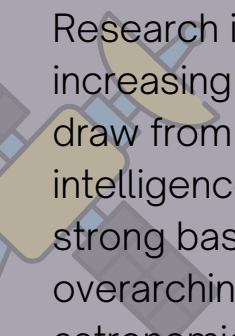
How is this relevant to the field of Astronomy?

Research in astronomy is making rapidly increasing use of analysis methods that draw from developments in artificial intelligence, machine learning with a strong basis in Bayesian statistics. The overarching questions raised in astronomical science are attractive to students from a wide range of disciplines and can provide the motivation for learning the fundamentals
of data science as they are applied to the astronomical domain.

One has to remember, that the astronomical sciences are some of the fields, which have the
largest collection and gathering of big data. Spacecraft imaging data from solar system
missions, spacecraft survey data for exoplanets, sky surveys at radio, infrared, and optical
wavelengths, data sets from gravitational wave detectors, and cosmological simulations of large-scale structure in the universe are the typical examples of data in this field. Almost all the
data is massive and classifies as big data.

Needless to say, such massive scales of data naturally demands data scientists and analysts to
organise and study it properly.

"...the astronomical sciences are some of the fields, which have the largest data collection and gathering of big data..."



Use of data science in astronomy can be largely found in the concept of data-driven astronomy (DDA). It is the production of astronomical knowledge based on archival data sets. DDA is similar to industrial data science in the way, that the data sets are not taken with the experiment in mind, but rather are a byproduct of other processes or investigations. Successful DDA needs to be quite close to the data and often involves working closely with instrument and survey specialists.

A great example comes from the Galaxy Zoo project from 2007, where astrophysicists were tasked with classifying 900,000 images taken from the Sloan Digital Sky Survey over seven years to determine if galaxies were elliptical or spiral, and if they were spinning or not.

"...answer lies in creating new data science models to measure large empirical and simulation data sets..."

The massive amount of data involved made human analysis almost impossible. One person would have to work 24-7 for three to five years to complete it. The answer lies in creating new data science models to measure large empirical and simulation data sets. These data sets encompass data from solar missions, exoplanet survey data, sky surveys at varying wavelengths, gravitational wave detectors, and large-scale astronomical simulations. And together, they help the astronomers reach their important research objectives.

Another common use of data science in astronomy is that of crowdsourcing, or the process of using thousands of “citizen scientists” to combine their efforts to map the skies and analyse data en masse. A project called Exoplanet Explorers used data from the NASA Kepler space telescope to discover at least five exoplanets (outside our own solar system). It is the first multi-planet system that was discovered completely by crowdsourced data analysis efforts.

The research first revealed a four-planet system, but later it was determined through further data analysis that a fifth planet was present. Over 14,000 volunteers participated in the crowdsourcing project, and they continue to view and analyse more data as it pours in over time.The astronomical sciences include data science as an integral part of the research process itself, and therein lies the interdisciplinary of the two. People from either background may find the other as a lucrative career option. The difference lies in the fact, that the former is specialised and requires domain knowledge.

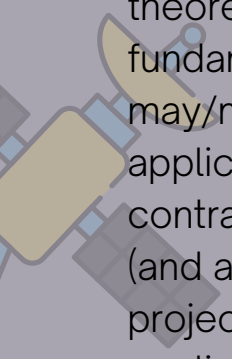
Research Scientist and Data Scientist:

While Research scientists study theoretical concepts on the most fundamental level, their area of study may/may not have immediate application in the real world.In contrast, Data scientists (and applied scientists) work on projects, that have immediate applications and consequences in the real world. A Data Scientist or an Applied Scientist, using data science, in the field of Astronomy may be delving into the details, but the project will mostly be focused on some problem to be tackled in the real world. A Research Scientist may be focused on developing an entirely new theory in the field, explaining previously unexplained phenomena. This may later lead to an innovation, but that is not the starting point for most Research Scientists.

Skillsets and Qualifications:

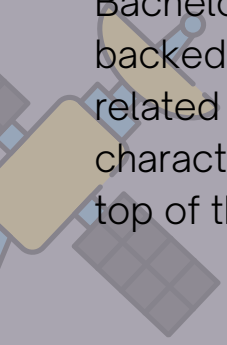
Any data scientist building models in astronomy related work would be expected to have a firm grasp of data science (refer the section on the skillset for data science).

"...People from either background may find the other as a lucrative career option..."



Additionally, having a prior understanding, atleast basic, of the domain of the work is extremely useful and is considered while hiring employees as either data analysts/data scientists/applied scientists. Domain knowledge helps to ease the process of building models and improves the quality of the product, since the data analyst knows what he/she is actually looking at. Thus, a BSc. Degree in the domain (Astronomy or related), or atleast some course in related topics is recommended.

Another point to stress here, is that data science is very project-based. This means, that actually having applied your data science knowledge in projects is highly appreciated by companies while hiring. Thus, a qualification in data science (any course, Bachelor's/Master's degree), if backed up by a project, especially in a related topic, is sure to be a characteristic feature of the top of the creamy layer of applicants.



"...actually having applied your data science knowledge in projects is highly appreciated by companies..."

Career Opportunities:

Applied Research Scientist:

Astronomical Research, especially applied Research, is inherently centered around data gathered from observatories, telescopes, space telescope, etc. This field is focused on the application of Astronomy to problems of practical concern / applications to other fields. Examples may include studying the impact of the solar cycle on weather, spacecraft lifetimes, etc.,

Research in the field of terrestrial radio interferometry with very long baselines and radio astronomy, Research in the field of fundamental coordinate-time support, Construction of fundamental reference systems and determination of the parameters of the Earth's rotation.
Data science is sure to find some application in this field.

Data Scientist and Data Analyst:

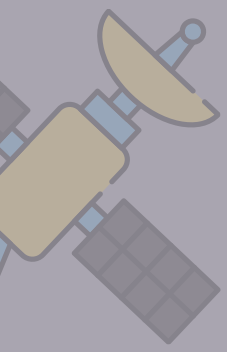
Using data science to build models / make predictions / achieve some end goal in the field of interest. Domain knowledge would add to the richness and quality of the research or product.
One of the key differences between a data analyst and a data scientist is what they do with the data.

Data analysts typically work with structured data to solve tangible problems using tools like SQL, R or Python programming languages, data visualization software, and statistical analysis.
This helps to see trends in the data.

Data scientists often deal with the unknown by using more advanced data techniques to make predictions about the future. They might automate their own machine learning algorithms or design predictive modeling processes that can handle both structured and unstructured data.
This role is generally considered a more advanced version of a data analyst. Designing predictive models and machine learning algorithms to mine big data sets, developing tools and processes to monitor and analyse data accuracy, building data visualization tools, dashboards, and reports, writing programs to automate data collection and processing

AUTHOR'S NOTE

Writing this article was as informative for me as it must have been for the readers. None of this would have been possible without the support of the entire team, which worked diligently to make this happen. This idea that I had, of writing on the applications of data science in astronomy, and of the intersection and interdisciplinary of the two, led me down a lane of researching this niche field. What emerged was a clearer picture, which I hope to have conveyed through this article. What's more, is that I hope the curiosity to explore such topics and careers has been ignited in the minds of readers. Cheers !



COGNITIVE SCIENCE

An interdisciplinary approach to understanding the mind

Sidharth Raman
in conversation with
Dr. Vishnu Sreekumar
&
Dr. Bhaktee Dongaonkar

Cognitive science is a highly interdisciplinary scientific investigation of the mind and intelligence, embracing philosophy, psychology, artificial intelligence, neuroscience, linguistics, and anthropology. A background in cognitive science is in elevated demand in many industries because it inculcates unique and interdisciplinary skill sets in an individual. With the primary objective to elucidate the significance of the field and the associated career opportunities available, the author constructively engaged in an insightful dialogue with Dr. Vishnu Sreekumar, directing the MANDA(Memory and Neurodynamics) Lab at IIIT Hyderabad followed by another dialogue with Dr. Bhaktee Dongaonkar, Assistant Professor at IIIT Hyderabad who heads the Stress and Cognition Lab.

In conversation with Dr. Vishnu Sreekumar

Can you please tell us about your main areas of interest within the field and your current research interests?

My primary area of interest is human memory and because I have a background in physics, I use a lot of dynamical system approaches to understand human memory. Now the kind of data that we use to understand memory are both behavioral and neural. And in the analysis of both behavioral and neural data, we adopt all these dynamical systems techniques, so it's a very quantitative approach but at the end of the day, we want to understand the mental and psychological processes underlying how human beings learn and remember information.

Please share your perspective on the highly interdisciplinary nature of research in cognitive science and the involvement of research scholars from multiple disciplines.

When I went to grad school, my PhD advisor was a computer scientist. I took courses in the Computer science, music and linguistics department, and all of these count towards a degree, in cognitive science or psychology. Also my peers in grad school came from a lot of different backgrounds, for instance, I had a physics background but one of my peers in the lab had a philosophy background, another one had a background in psychology, and when all of these people get together, obviously we have complementary skills and you naturally bring diverse ideas to the table and think of more innovative solutions to problems in cognitive science. Even here at IIIT Hyderabad we have students from a lot of different backgrounds, most of our thesis students are pursuing degrees in Computer Science or Electronics, some of them come from computational linguistics department, and many of our PhD students come with humanities backgrounds.

What we do here is that people with a background in philosophy or humanities are trained in how to think systematically about a problem, but they don't necessarily have the technical skills to write an app for data collection. However, when you put these people with people having relevant technical skills, they'll learn from each other, and come up with very satisfactory solutions to problems in cognitive science. From my perspective, a lot of Indian institutes or universities are well set up because you have all these different disciplines and I think traditionally our institutions are strong in domains like engineering, physics and math.

"...However, when you put these people with people having relevant technical skills, they'll learn from each other, and come up with very satisfactory solutions to problems in cognitive science..."

How would you say your initial education in physics has influenced your work? Knowing what you know now, would you have pursued your undergraduate and graduate studies differently?

If I had to do it all over again, I would still probably do physics. I had my undergrad in physics because I was interested in learning the subject, it was only towards the end of my 5 year program at IIT Kanpur that I started taking electives in linguistics, philosophy, sociology and psychology, and through these electives, especially the ones in linguistics, I got very interested in this field of trying to understand the human mind. Since I did my undergrad and masters in physics, I feel like I am equipped with a lot of skills that are very useful for my work right now. And there are lots of powerful methods that come from these other domains that are widely used today in neuroscience, even things like topology play a major role in our understanding of neuronal activity at this point in time.

"... I think all of these different backgrounds bring very useful skills to the table because the human mind is a huge and complex domain to study and it is very useful to have knowledge and skills from these related domains...."

If you were to ask somebody else who is currently a neuroscientist who may have a background in pure math or associated discipline, I don't think their answer would change either. I think all of these different backgrounds bring very useful skills to the table because the human mind is a huge and complex domain to study and it is very useful to have knowledge and skills from these related domains. To answer your question, whether I would have done things differently, I don't think so. But if I were to be compelled to do something other than physics, I might choose Computer science, or even math but something with computing in it since it is very useful in the field of cognitive science.

How did you come to think of cognitive science as a viable option for further studies, and what were the initial steps you took to move down this career path?

I think when I took these electives, my linguistic professor at IIT Kanpur, Prof Achla Raina, detected that I had an aptitude for this field.

After an elective that I took with her, she gave me a chance to do a PhD level reading course with one of the PhD students at the time. We were basically reading some of the best papers in history in cognitive science and discussing that, and it was a lot of fun where we got to freely explore these ideas and by the end of it, I was also feeling that maybe I should go and do more work in this field, because I seemed to have an aptitude and liking for it and I felt like my quantitative training in physics would also help. With a lot of encouragement from professor Achla Raina, I decided to apply to grad school, but even at that time, I wasn't sure if I wanted to go to psychology or linguistics, even though linguistics is what got me interested, and being an amateur musician I was also interested in the field of musical cognition, so I ended up applying broadly, and I got accepted to at least 3 Ph.D programs. Then in the end, I made the decision based on the practicality, and affordability of the city that this was offered in, and I ended up going to Ohio State University to do psychology. Since I was interested in general in the field, what mattered to me were the practical aspects of it. I happened to work on human memory and mathematical modeling of human memory, and I ended up liking the work so much that that is what I specialize in now.

What would you say about cognitive science being a prospective career option for natural science students from IISER, especially those majoring in physics or mathematics?

I think we need a lot of people in India to take up cognitive sciences because it is still a relatively young field and there are lots of problems that can use more researchers to solve.

Given the kind of talent in the country at the undergraduate level, I do think that with the right sorts of exposure to a field like cognitive science, India can make a lot more contributions to the field in the future. This is one of the reasons that I returned to the country.
I think IISERs have a unique culture of research thinking and it is naturally suited for a field like Cognitive Science, it doesn't have to be necessarily Cognitive Science, I am just saying that the people who tend to go to IISER, have a higher than average interest in research and people with a background in physics, math or natural science like I said earlier, will be able

to find that they'll be able to contribute in the field of Cognitive Science. And of course, I think it might be a personal opinion but Cognitive Science is a very rich field with lots of problems, enough to keep a lot of different people interested, and this is why I think that students at IISER should explore Cognitive Science, if they are interested.

To answer your question on whether the career path is viable, there are two main kinds of paths that you typically talk about, when it comes to research oriented domains, one naturally is academia, where you do the standard training, and go for a PhD, followed by a postdoc.

"... In India there are many faculty positions open across a wide range of universities and institutes and since Cognitive Science is still up incoming, I anticipate that these departments would start propping up all over the place because in the industry, at least in the US, and probably in the Europe, there is a clear contribution coming from Cognitive Sciences. ...."

This trains you for a faculty position where you do both research and teaching. In India there are many faculty positions open across a wide range of universities and institutes and since Cognitive Science is still up incoming, I anticipate that these departments would start propping up all over the place because in the industry, at least in the US, and probably in the Europe, there is a clear contribution coming from Cognitive Sciences. If you look at companies like Toyota, who constitute self driving cars there is a clear element of humans in the loop. For example, in order to design better assistive technologies for driving, you may need to understand the human attention lapses, cognitive controls and related things. Similarly in healthcare, there is a lot to understand about humans in the loop. As of now, in India, the industry options are restricted to User Experience. However, in the future, if you need AI design for applications in different domains and you want humans to interact with AI in these applications, then you need Cognitive Scientists who understand how the brain works to help you build these technologies. In that sense, I think there's a lot of potential for employment across both the industry and academia.

Please talk more about industry oriented prospective job opportunities in cognitive science, globally and how is it likely to grow?

I can tell you more about what I know about my friends who did PhDs in Cognitive Science, some of them work in companies like meta, doing research on areas like User Experience, both qualitative and quantitative. Individuals also join startups doing similar kind of work. I have another friend who works as a research scientist at Toyota Research Institute. I myself interviewed at Deep Mind during my PostDoc. It depends on where you can train, what you can get trained on, whether you have a background in machine learning, AI, along with your Cognitive Science training and depending on how you get trained you can have these doors open to you. I am sure that there are many other possibilities like when it comes to reinforcement learning, it is obviously not only for AI, but also relevant for humans & in understanding how humans learn in the real world, we have come up with many models, even studying the brain and the hippocampus, what kinds of algorithms probably operate in the hippocampus, and using those insights in AI. I know several people who got employed by companies like Microsoft, where they are leading research teams based on their training in Cognitive neurosciences.

If you have good Cognitive Science training and you don't restrict yourself in thinking very narrowly during the course of your training, and if you're able to think of different domains alongside, then you're likely to be successful in gaining employment in one of these very interesting and some of these very high paying domains.

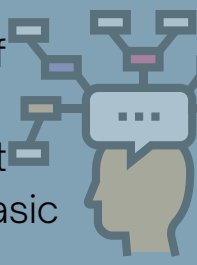
"...If you have good Cognitive Science training and you don't restrict yourself in thinking very narrowly during the course of your training, and if you're able to think of different domains alongside, then you're likely to be successful in gaining employment in one of these very interesting and some of these very high paying domains. ...."

In Conversation with Dr. Bhaktee:

I would like you to talk about your primary areas of interest and your current research interests? What would you say is the most exciting thing for you about working in your field?

My primary areas of interest include memory and understanding how memory processing happens in the brain, how we can explain what we remember, what is the mechanism that helps us remember over time and what is the brain processing that's going on in the background when we remember and what brain regions are involved for different kinds of memories.

I use stress as a modulator and as a mechanism to modulate the brain regions in order to see how memory processing can be modulated or changed by interrupting the normal activities of the brain regions by inducing stress, and which is an ecologically relevant way of modulating the brain.
Because it relates to what we experience, the most exciting part is that you can bring a lot of intuitive & curiosity driven aspects to your research, you can ask very basic & interesting questions that help you to understand yourself as well as how your own brain functions. This explains a lot of behavior and a variety of dimensions in our society, right from economic decisions to basic emotion related decisions.



"...Because it relates to what we experience, the most exciting part is that you can bring a lot of intuitive & curiosity driven aspects to your research, you can ask very basic & interesting questions that help you to understand yourself as well as how your own brain functions. ...."

How would you say your early training as an engineer influenced your work? What role did your engineering background play in your career as a cognitive scientist?

I think my background in electronics engineering helped me to understand how the electrical activities in the neuron are regulated.

Having those fundamentals pushed me more towards understanding the neuroscience aspect of the brain including how neurons conduct electrical current versus how an electrical circuit conducts electric current. But when you understand how neurons function, it also gives you ideas about how it's actually compiling or manifesting the behavior that you observe to some extent, though not completely. You don't understand everything from circuits but it does give you an estimation of the computational processing that may be going on at the neural level.

"...What I am trying to highlight here is it's a continuous process of evolving. One thing leads to the other and I too need to keep learning new things all the time. ...."

How did you come to think of this field as a viable career option, and what were the initial steps you took to move down this career path?

After my graduation or even during the course of my graduation, I was interested in exploring how the brain works, but 20 years ago there were no courses offered on brain & behavior in India. Fortunately, Allahabad University had only recently started a course in Cognitive Science which I ended up taking. Even before I entered cognitive science, I was interested to know how stress affects our learning and memory abilities. And I've been doing that ever since, through my masters and PhD. After my masters, I applied for PhD programs in 5 universities and got selected in 2. Considering the finances and fellowships offered, I chose University of Arizona. During the course of my PhD I tried to understand memory and how it isn't static and changes over time. If you think of memory as something we just remember, it's not just the case. It is not an input-output mechanism. It is a dynamically evolving process and I studied how stress affects memory processing.

I came back to India for my post-doc and extended the study in people with depression and bipolar disorder, trying to understand how memories change in them over time. I am still looking for students interested in expanding that work. Now I'm venturing into cognitive ageing. I am also interested in decision making processes that are related to memory. What I am trying to highlight here is it's a continuous process of evolving. One thing leads to the other and I too need to keep learning new things all the time.

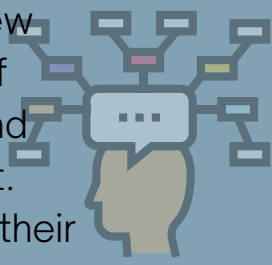
What is one thing you'd want most undergraduates to appreciate or understand about writing or research in your field?

The fact that it is multidisciplinary and the same topic can be studied from so many perspectives. Infact, the scope of studying is unlimited. Just having a narrow view doesn't help sometimes, it is essential for you to read things broadly. It is important to understand that one shouldn't limit oneself to thinking about cognitive science with a constrained approach, since learning is a continuous process in the field.

What would you recommend undergraduate students to do to decide upon cognitive science as one of their career options or career paths? How can they explore?

In India, cognitive science is offered mostly at the postgraduate level. Here, at IIIT Hyderabad we offer it as an elective to undergraduate students as well, so that they may use it along with their expertise in computer science and electronics,

and they can also do projects that are interdisciplinary across domains, if they are interested. From my perspective, with the new National Education Policy, you can start applying for PhD programmes in cognitive science after an undergraduate degree. A few universities like University of Allahabad and IIIT Hyderabad accept the score on CogJet. Others, including IITs, have their own entrance exams and they're basically looking for interested candidates with a very fundamental background but interest in interdisciplinary research.

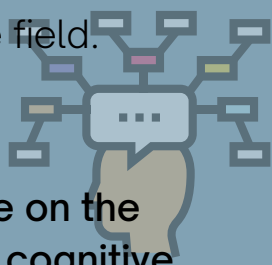


How do you recommend students should proceed to make a career out of this field? It could be internships, reading projects, or jobs.

Doing internships during the course of your summer break is a good option, but spend your summers constructively, just don't go there and observe, engage yourself actively in doing a small project or a literature review, the primary objective should be to have an output at the end of the internship.

"...It is also important to understand that these research studies aren't quick, for instance, a lot of computational and biology studies might happen within a few months, and sometimes, cognitive science studies in humans can take a few years to collect data....."

If you're changing fields, becoming a Research assistant in somebody's lab is a good option as well. People who want to venture into different fields need to spend maybe a year at least in order to familiarize themselves, or to decide whether they want to be there or not in the first place. If you want to transition, spend a little time understanding whether it interests you, because from the outside it might seem a little interesting but when you actually enter the field and get to know all the nitty gritty things that you need to do, you may lose interest and change your mind.
It is also important to understand that these research studies aren't quick, for instance, a lot of computational and biology studies might happen within a few months, and sometimes, cognitive science studies in humans can take a few years to collect data. It is therefore imperative to have patience and long-lasting interest in the field.



Will you please talk more on the computational aspect of cognitive science, and the opportunities available for students with a background in Computer Sciences?

Students with a background in computer science may start by taking courses on Computational modeling that try to understand the very basic mechanisms of what happens in the brain and what models are built around to understand those. For this purpose, they may take online courses or work with someone on a project, as an intern. The other way is reading as much as you can understand. I think a professional or formal way of approaching this is by taking elective courses that may be offered, like interdisciplinary courses to understand the thought process because when we get CS students, the manner and process of thinking is very different from the one that is needed for cognitive science. You need to think more and be curious, you need to open up your thought process and vision to wider topics. Traditional computer science courses are driven primarily towards job seeking. For research, you need to have a wider variety of reading and curiosity to explore and learn all the time.

"...Cognitive Science involves working with large amounts of data and observing trends in them. ...."

Talking about the opportunities available for Cognitive Science students, now they are increasing. Academic research is one avenue where people go. Another is where people require analysis of data, if you've been trained in this domain as part of your cognitive science training, and if doing statistical analysis is your strength then you can actually go into data analysis or data science streams as well. Cognitive Science involves working with large amounts of data and observing trends in them. Research analysis, UX research and designing are some of the positions that have come up in the industry in recent years and the best of the companies have these positions, including startups.

Apart from this, people go into marketing, their role is to understand human behaviour and how market trends can be regulated.

People who are interested in writing and communication may work in science communication or science journalism since they have a multidisciplinary aspect of understanding science.

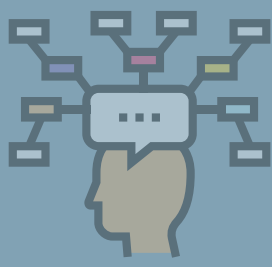
AUTHOR'S NOTE

“Cogito, ergo sum”

~Maybe you've heard of this dictum coined by René Descartes that translates into “I think, therefore I am”. The inherent curiosity to understand the human mind, and its functional mechanism, coupled with the subjective philosophical idea of consciousness has always been fundamental to human civilization.

From having a prehistory traceable back to ancient Greek philosophical texts, to the realm of artificial intelligence.

What we inherently seek to understand is what compels us to question, to think, and then drives us to explore, and understand, and in this process, we sometimes find answers to questions that weren’t even our own. From my perspective, the idea of learning isn’t constrained to domains, the primary objective of learning is to propel an individual to question the fundamentals, and to find answers to these questions. The process may involve multiple-disciplines and cognitive science is no different, it is multi-dimensional in the sense that it is inclusive of very fundamental aspects of human life- from emotional responses, to economic decision making.



7

Development Economics: From Despair to Dignity

Aradhya Jindal
in conversation with
Dr. Sandip K. Agarwal

Have you ever wondered how development economics is of any value to us in the current world? Well to understand this let's look at India.

Right now India being one of the largest middle-income countries in the world stands at a pivotal moment where if we manage to utilize our current demographic dividend of such a high working population we, like China, might be successful in achieving a 'golden era' of economic prosperity. Now it is imperative to understand that if we are unable to use this opportunity in the most effective manner we might get stuck as a middle-income country which is often addressed as a middle-income trap, hindering further progress.

With such a landscape of problems, India requires a systematic approach to address various factors: skill mismatch, insufficient job creation, and structural issues in our current economy. This is one such problem where a development economist's involvement is valuable and can help guide our country in understanding why is India even going through an unemployment crisis, what other problems can such a large population of unemployed youth create; and thus, in understanding this can help address them with strong and effective economic policies steering India towards a better future and so on.

This article delves into the realm of development economics, exploring the multifaceted aspects of the job market which draws from an authentic interview with one of our esteemed professors at I**ISERB -- Dr. Sandip K. Agarwal.** This article provides an understanding of the subject and a rough roadmap for those interested in pursuing a career in this field, by examining the Current challenges, trends, and potential solutions.`

1) The Evolution of Development Economics.

After World War II, the International Bank for Reconstruction and Development (IBRD), now known as the World Bank, was established to stabilise war-ravaged economies. Many economies witnessed significant growth rates with the aid provided by IBRD until the 1970s. As a result of this success, the same development model was sought to be applied in the case of developing countries.

However, the application of the same development models in developing countries did not yield the same result as they did in the context of the war-ravaged countries. One of the reasons for this is due to the unique nature of a social scientist's 'lab' being society itself, where the subjects are rational humans having inherently subjective experiences, making it extremely difficult to perform controlled experiments. Unlike non-human experimental subjects, whose behaviour is predictable in controlled settings, human behaviour presents complexities that make it difficult to replicate policies across different socio-economic, cultural and political contexts – as these influences behaviour significantly.

"...One of the reasons for various polices working in one context but, failing in another is due to the unique nature of a social scientist's 'lab' being society itself, where the subjects are rational humans having inherently subjective experiences, making it extremely difficult to perform controlled experiments...."

With disparate societal structures and contextual factors, implementing the same policies in different contexts yields hi hello? divergent outcomes, sometimes resulting in ineffectiveness or even exacerbating the situation.

Another reason for this difference lies in the history of imperialism and colonialism. Many developing countries had been colonies of European nations, experiencing exploitation and degradation. This is one of the reasons why the problems encountered by developing countries differ significantly from those faced by the now-developed Western nations. Therefore, development economics requires more context-specific policies tailored to the unique challenges of developing countries.

"...Recognizing the challenges, there has been a shift towards a broader and more holistic concept of development with the introduction of impact evaluation."

Recognizing this limitation, there has been a shift towards a broader and more holistic concept of development with the introduction of **impact evaluation.**

2) Examining the Effectiveness of Development Policies in the Indian Context.

Impact evaluation is an assessment of how the intervention affects outcomes and whether these effects are intended or unintended. **Randomised controlled trials (RCTs)** are an experimental form of impact evaluation in which the population receiving the programme is chosen at random from the eligible population and a control group is also chosen at random from the same eligible population. It tests the extent to which specific, planned impacts are being achieved.

They have long been used in medical sciences and now they have been becoming crucial in development economics, often considered the gold standard in any policy-making. In India, RCTs have been conducted to evaluate the impact of cash transfer programs, education interventions, healthcare initiatives, and governance reforms.

In the late 1990s and early 2000s, there was a focus on microfinance to address the poverty trap, exemplified by Professor Muhammad Yunus' **Grameen Bank** in Bangladesh. The idea was that – access to credit could break the poverty trap. While initially considered revolutionary, the effectiveness of microfinance in eradicating poverty has since come under further scrutiny.

In recent years, economists have been actively addressing the limitations and criticisms of developmental economics and its policies.

"...One notable organisation that has made significant contributions in Development economics is the Abdul Latif Jameel Poverty Action Lab (J-PAL)...

...In India, among various introduced programs addressed towards the issue of poverty trap MGNREGA is one such successful initiative..."

One notable organisation that has made significant contributions in this field is the **Abdul Latif Jameel Poverty Action Lab (J-PAL)** mentored by Duflo, Abhijeet Banerjee and their network of development economists.

In India, to address the issue of the poverty trap government has provided free education, healthcare subsidies and implemented various poverty alleviation programs, one such successful program is The **Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)**. The Act ensures 100 days of employment every year for every rural household. Also, under the programme, if an applicant is not employed within 15 days they will be entitled to a daily unemployment allowance. This act now serves as a safety net for the rural population during lean seasons. It has played a significant role in reducing poverty, improving schooling rates and enhancing physical and mental health, thereby enhancing the livelihood of millions of rural households.

Furthermore, the role of MGNREGA as a safety net for rural households became much more evident during the pandemic.

3) Prominent Research Institutions in Development Economics.

"...J-PAL is one such organisations that has successfully tackled the challenges of global poverty. Their success in addressing the divide between research and practical implementation has led to its expansion into many countries worldwide..."

There are several evidence-based policy research centres that not only generate impactful research but also make sure to constantly connect their work to the impact on the ground. Moreover, they consistently work with hundreds of governments and NGOs to enact large-scale meaningful change.

J-PAL is one of the organisations that has tackled the challenges of global poverty quite successfully. Their success in addressing the divide between research and practical implementation has led to its expansion into many countries worldwide.

J-PAL is a research centre founded in 2003 by Abhijit Banerjee and his colleagues with the ambition to reduce poverty by promoting evidence-based policy decisions. By using randomised controlled trials (RCTs) and other rigorous evaluation methods, they provide policymakers with concrete evidence on what works and what doesn't to achieve realistic goals towards a better future for all.

Other think tanks and research institutions that work in multiple countries are:

- World Bank's Development Economics Group
- Centre for Global Development
- Consultative Group on International Agricultural Research (CGIAR)
- Brookings Institution

Furthermore, some other India-based organizations include: the Development Data Lab and the Centre for Policy Research[1]

1 For more India-based organizations, this list from Women in Econ and Policy is fairly comprehensive.

4) What are some potential career paths for someone interested in pursuing a career in development economics?

"...Since career in development economics is not something you choose in your undergrad, many prospects of other jobs are available as an economics major. However, if you do aspire to specialize in development economics, there are several broad career paths that you can explore. Here are some potential avenues to consider..."

When it comes to potential career paths options are primarily oriented towards policy-making. The government sector offers quite a few opportunities, particularly in shaping policies and implementing development initiatives. Work in NGOs, think tanks and academia also provides a good platform. Some potential career paths can include:

1) Policy Analyst: This role often exists within government agencies, international organisations and think tanks. Your major tasks here involve conducting research, analysing data and providing evidence-based recommendations to inform the design and implementation of development policies and programs. It should be noted that more established think tanks like JPAL are highly selective.

2) Researcher: Research institutions and universities employ economists to study various aspects of economic development, poverty alleviation and inequality.

3) International Development Consultant: They work with governments, international organisations and private firms to provide expertise on development projects. They analyse economic trends, assess project feasibility and provide strategic recommendations for achieving development goals.

4) Program Manager/Coordinator: Non-governmental organisations (NGOs) often seek program managers or coordinators to oversee the implementation, monitoring and evaluation of development projects on the ground. These roles require a combination of project management skills, economic knowledge and an understanding of local contexts.

5) Social Impact Analyst/Evaluator: The objective of SIA is to ensure that development maximises its benefits and minimises its costs, especially those costs borne by people. They utilise quantitative and qualitative data to understand the successes of certain policies and make opportunities for further improvement.

5) What skills are most valuable in this field?

In terms of valuable skills for a career in development economics, there are a few key areas to focus on:

1) Strong Understanding of Econometrics: With the availability of data, computing prowess and advances in causal methods for inference and impact evaluation of policies, the field has become more evidence-based. Being able to effectively analyse data and draw meaningful inferences is at the centre of an applied economist's job, highly valuable in academia, policy-making as well as corporate. In addition, having a good sense of data with hands-on statistical programming is always a plus point.

2) Unbiased Perspective: Being open to criticism of one's work and maintaining an unbiased perspective towards research is very essential, which is, in general, necessary for any kind of science to progress.

3) Solid Foundation in Micro-Econometrics: In addition to econometrics, a solid foundation in microeconomics is a general rule of thumb for any economics-related field. Understanding the behaviour of individuals, households, and firms at a micro level is fundamental in shaping effective development policies. This intersection of microeconomics and econometrics is often referred to as micro-econometrics, which involves applying econometric techniques to microeconomic data.

4) Communication and Collaboration: The ability to communicate complex economic concepts, both in written reports and oral presentations, is crucial for engaging with stakeholders, policymakers, and the public. Hence, the ability to communicate economic concepts to a layman is extremely important - as development economists often have to collaborate and work with non-economists.

6) Some recent advancements in development economics and the impact of new technologies.

"....Economists now have access to vast amounts of data from diverse sources. This is significant as they can now shift their focus away from data collection and dedicate more time and effort to their primary work of analysing and utilising this data to inform their economic analysis and decision-making processes...."

One notable development has been the increasing emphasis on behavioural economics, which incorporates insights from psychology and social sciences into economic analysis.

Advancements in data analysis and technologies have revolutionised the field of development economics. Economists now have access to vast amounts of data from diverse sources such as satellite imagery, mobile phone records, and social media. This is significant for economists as they can now shift their focus away from data collection and dedicate more time and effort to their primary work of analysing and utilising this data to inform their economic analysis and decision-making processes.

Access to a diverse range of data sets provides unique solutions to various problems faced by economists. For instance, in India, the problem is that the farm sizes are small and if you try to build an insurance product for them, the transaction cost is very high making it infeasible. But with effectively using data obtained from satellite imagery, this problem has been addressed in India and even in Kenya, Canada, USA using what we call **NDVI (Normalised Difference Vegetation Index)** — This index quantifies vegetation by measuring the difference between near-infrared (which vegetation strongly reflects) and red light (which vegetation absorbs). This helps farmers raise healthier yields and save money on fertilizers.

"....It's worth noting that research and policy-making are not mutually exclusive paths. Also, due to the highly competitive nature of the PhD programs in the US and Europe, many aspiring economists prefer to work as RAs (Pre-doc) and build their network....."

The concept of such index-based insurance (IBI)[2] is that it attempts to achieve settlements based on the value taken by an objective index rather than on a case-by-case assessment of crop or livestock losses. This demonstrates how data analysis can play a crucial role in devising strategies to tackle obstacles and promote the successful implementation of insurance schemes

7) PhD for further research in development economics or entering the field directly after completing graduate studies.

It's worth noting that research and policy-making are not mutually exclusive paths — and the two can overlap. Many professionals in developmental economics engage in research and policy-making, conducting rigorous research while actively participating in policy discussions and providing practical recommendations.

[2] For further understanding of how satellite-index-based insurances work click here.

Ultimately, the choice between a research-oriented or policy-oriented career depends on your interests, strengths, and long-term goals.
While development economics deals primarily with the economic problems of the Low and Middle-Income Countries (LMICs) - the global south, the most impactful research in development economics is being done in the top schools in the West. Needless to mention, research in development economics is resource intensive (of which a strong academic network is a highly valuable resource). Also, due to the highly competitive nature of the PhD programs in the US and Europe, many aspiring economists prefer to work as RAs (Pre-doc).

8) What are some qualities that could be important for someone looking to adopt this career?

One must not shy away from expressing their thoughts and ideas.
Also, observational skills and the ability to communicate with empathy are encouraged to better address the problems faced by the masses. Intrestingly, students in developing countries do have an advantage here as they understand poverty and its relevance to development economics.

9) Some resources that aspiring students could use to learn more about this field. And How can aspiring students get involved in research projects?

Aspiring students can enrol in the **MITx MicroMasters Program in Data, Economics, and Development Policy.** It is taught by some of the world's top development economists, enrolment fees are adjusted to your ability to pay (or free if you don't want the credit), and performing well in it can allow you to apply for an in-person master's program at MIT to continue your education in one of the world's top programs in this field.

At **IISERB**, we are all involved in various research projects. Aspiring students can reach out to us through email or keep an eye on the IISERB website where we often post research project opportunities. But, research projects are not just about joining a predefined project. We value the personal aspect of research, where students pursue their interests, learn, and engage in discussions with us. It's a mutual process where we both enhance each other's thoughts and understanding. A good start could be interacting with the Masters and PhD. students and discussing their research. So, if you're passionate about research, don't hesitate to reach out to us or explore the resources available at IISERB.

AUTHOR'S NOTE

As the author, since this article includes both the interview bits and my research relevant to the field I must admit that writing this article was a demanding process and I hope you gained something from it. I have tried to put my best in this article and it has been a journey of learning. This article would certainly not have been as good as it is now without the help offered by the SDC team and my friends, whom I repetitively pestered with pointing out the flaws in this article. Also, the insightful interview with Professor Sandip K. Aggarwal was very helpful in giving structure to this article and allowed this article to have depth and credibility.

Writing this article has granted me profound insights into the field of development economics. It is a competitive domain that holds great potential for those passionate about uplifting the underprivileged. Through effective approaches, we can fuel a nation's growth, improve countless lives, and ensure the well-being of the less fortunate during difficult times. It is my sincere hope that reading this article not only will inform you about this field but also sparks a desire within you to explore further and delve deeper into this fascinating field.

Our Team

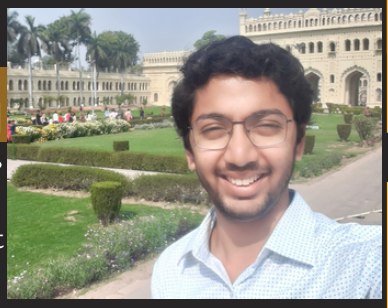
Ashish Raj
Design

Nirlipta Khandai
Design & content editing

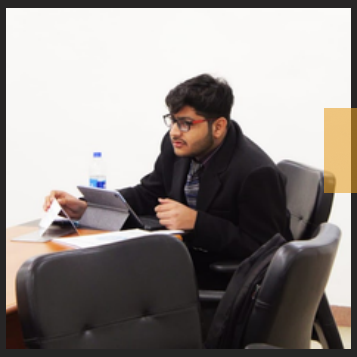
Hemal Bapat
content development

Barishan Das
content editing

Manas Nandan
content development



Aneesh Diwanji
content development



Sidharth Raman
content development

Kaustubh Nyati
content development

Aradhya Jindal
content development

Harsh Tandon
content development

SDC | IISER BHOPAL

SDC | IISER BHOPAL